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ABSTRACT

Two aspects of educational technology are considered. The first involves the development of educational technology highly dependent on computer equipment, and the development of a computer assisted instruction language called Programmed Language for Interactive Teaching (PLANIT). The second aspect involves the development of educational technology which is quite unrelated to equipment. The example given concerns an attempt to develop a tutorial community which is not related to hardware or equipment but rather to techniques of instruction, student-teacher relationships, and community interaction. (MF)

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EDUCATIONAL TECHNOLOGY--
COMPUTER-RELATED AND PEOPLE-RELATED

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EDUCATIONAL TECHNOLOGY--COMPUTER-RELATED AND PEOPLE-RELATED

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I. INTRODUCTION

Today I will discuss educational technology in a broad context and then give two examples to illustrate the general points I am making. In the first section I will present several characteristics of technology and then relate these considerations to educational technology specifically. I will then consider two examples, one involving the development of educational technology highly dependent on computer equipment and the other the equally complex and difficult development of technology which is quite unrelated to equipment. The first example describes an effort to develop a computer language which is particularly adapted to computer-aided instruction. You will see that while the development of this language is dependent on a certain computer hardware configuration, the important point of the development is not the hardware but rather the software; that is to say, the computer procedures and the kinds of capabilities that are developed for the use of the instructor and the student. The second example concerns an attempt to develop a tutorial community which is not related to hardware or equipment but rather to techniques of instruction, student-teacher relationships, and community interaction. I cite these examples mainly to show that they involve the development of skill in the use of quite complex and involved techniques, whether or not physical equipment is involved.

II. GENERAL TECHNOLOGY AND EDUCATIONAL TECHNOLOGY

The general public, and also many engineers and technical people, have the common misconception that technology relates primarily to the development and application of various types of equipment. Among general theorists of technical and economic development, technology implies a considerably broader conception. Recently a group of economists at the Brookings Institute (8) defined technology in this way: "Technological knowledge is a set of techniques, each defined as a set of action and decision rules guiding their sequential application that man has learned will generally lead to a predictable (and sometimes desirable) outcome under certain specified circumstances." You will note that in this definition there is no mention of hardware per se but rather an emphasis on a set of techniques which will lead to a predictable outcome. This same point of view is being emphasized in educational theory. Recently Robert Gagne, in a most perceptive article titled "Educational Technology as Technique," (4) made the following point: "Educational technology can be understood as meaning the development of a set of systematic techniques and accompanying practical knowledge for designing, testing, and operating schools as educational systems. Technology in this sense is educational engineering. It draws upon many disciplines, including those which design working space, like architecture; those which design equipment, like the physical sciences; those which design social environments, like sociology and anthropology; those which design administrative procedures, like the science of organizations; and those which design conditions for effective learning, like psychology." Later Gagne says, "Technology in this meaning may or may not involve hardware. Sometimes it does, frequently it does not. It often involves changes in what 'hardware' people call 'software,' which is a highly ambiguous term. Specifically, though, applications of modern technology are the development of new kinds of student record cards, course outlines, study guides, lesson sheets, workbooks teachers' manuals, and tests. Any or all of these may be needed to carry out new kinds of instructional procedures."

What then is the essence of educational technology? Keeping in mind the points just made, it appears that the goal of educational technology is to define those procedures and techniques which if followed will lead to the attainment of various educational objectives. The definition of educational objectives is not a concern of educational technology in itself, although the rigorous nature of educational technology forces a clearer statement of educational goals. As I will point out later, the instructional management system developed by Coulson and his co-workers (2) resulted in a much clearer definition of educational objectives than had previously existed. These more exact definitions would not have been needed had it not been for the development of specific techniques for achieving the general goals. Thus broad educational goals do not depend on educational technology but are often refined within the context of the development of a technology.

To some extent educational technology defines the environment in which educational objectives may be achieved. The technology helps define the conditions under which effective motivation can be achieved, the conditions under which the achievement of the learning objectives can take place, and the conditions which will maximize the progress of the individual student toward the achievement of these defined objectives. Thus as we learn more and more about educational technology we should develop a body of systematic knowledge and procedures which can be applied to the definition and achievement of specified goals. As we work on various specific projects experience is gained in using the techniques applied. Slowly a body of technical principles and methods are formulated which are readily utilized as new projects are attempted. Knowledge of these techniques and the development of methods to achieve the effective application of this technology should become the subject matter to be mastered by all educational engineers. Thus a new emphasis and role in the education profession may develop which places much greater importance on the development and transmission of new techniques to those who are actively involved in the instruction of students.

III. THE INSTRUCTOR'S UTILITY SYSTEM--A COMPUTER-AIDED INSTRUCTION (CAI) LANGUAGE

For a number of years SDC has been interested in the technology of instruction. Indeed, I believe we built and demonstrated one of the first computer-based teaching machines. As we worked with this machine and several later ones, it became apparent that there was a need for a special programming language which would allow a non-programmer--a school instructor unfamiliar with programming--to develop lesson material for presentation through a computer. We therefore developed a CAI language called PLANIT. Most of the early developmental work on PLANIT was done by Chuck Frye and Sam Feingold. This language was developed on SDC's Q-32 computer. It was used in connection with several projects involving the teaching of mathematics and statistics. Experts who had experience with the language felt that it had a number of advantages over other languages.

While computer languages such as FORTRAN can be used to write instructional material, they are so complex and difficult for the non-programmer that most teachers cannot develop their own lesson material using these languages. Another problem in the CAI area is the fact that many different computer languages exist, and thus lesson materials written at one institution are frequently of little use at another institution because the language on which they are based cannot readily be translated. Since we recognize the validity of these criticisms of CAI developments, we felt it would be desirable to improve and translate the PLANIT language into a form which would make it widely available. We proposed to the National Science Foundation that they support us in undertaking the development of a computer-based instructor's utility system which would be made available to all who were interested in doing research and development in the computer-aided instruction field. The National Science Foundation agreed with the need for such a development and has supported the project I am about to describe.

We are now developing a new language capability which we hope will go a long way toward becoming the standard language used in CAI research and development

as well as being used in the construction of instructional materials. In this way new developments and lesson materials can readily be exchanged from one organization to another. This new effort is under the direction of Dr. Charles Frye. It is being developed in such a fashion that it can readily be translated to any brand of machine having the general capabilities and memory size of an IBM 360-40H. The language is being written in FORTRAN IV, which is probably the most common of the scientific languages. Since the system must be able to display materials to a number of students simultaneously, it operates under its own time-sharing executive system. Under our contract to NSF we are committed to developing a system which will handle at least 20 students simultaneously, but Dr. Frye believes that the design will well exceed that required and will handle from 50 to 100 students simultaneously, depending on the complexity of the material being presented.

What are the characteristics of this instructor's utility? The designers of the PLANIT language are both educators and programmers. A manual (3) has been developed which describes the language and is available to any researcher interested in doing work in computer-aided instruction. I think of the PLANIT language as primarily having two modes: one mode is that used by the instructor in developing instructional material, while in the other mode the student responds to the material the instructor developed. The instructor mode has a number of capabilities. The instructor does not need to be a programmer but he does need to be familiar with the conventions and capabilities of the PLANIT procedures. Basically, the instructor decides on the objectives of the lessons he wishes to prepare and the content which he wishes to have presented to the student. He then uses a console to compose instruction frames which can take many different forms. For example, the instructor may wish to simply present a sequence of instructional material which the student would read without giving any response, or the instructor may wish to ask questions and have the student respond to the questions. The instructor may formulate multiple choice questions. He may decide that the particular problem to be

presented the student should depend on various previous responses, in which case he may use the so-called decision frames; that is to say, the type of situation which is "conditional" in the sense that if the student has a particular past series of response, a specified presentation is appropriate. The main point here is that PLANIT has a great deal of flexibility in the nature of the instructional material that the instructor may wish to present and in the form in which he can present it.

When the instructor prepares the instructional material he decides on what particular action should be taken for different possible student responses. If, for example, the student gives a correct response the instructor may wish to reward him with a specified phrase or he may wish to have a phrase selected from a list of reward phrases. If the student responds incorrectly, the instructor may wish to present the frame again, or he may wish to present other instructional material, or he may wish to make suggestions to the student. All of these options are available to the instructor. He can pre-specify what response should be presented to the students, depending on the type of response the student has given. PLANIT has the special capability that if the instructor wishes, it will consider as a correct response a "key word" in a response phrase, or it will accept a response which is the algebraic equivalent of the response, or it will accept a response which is phonetically similar to the correct response. In short, the instructor has a great deal of flexibility in the rigor or freedom he wishes to allow the students. PLANIT also is capable of recording student responses. While making up his lesson material, the instructor can decide on what kind of recording he would like and program this into the lesson material itself; or he can later specify the records to be retained. Finally, the instructor has available a considerable mathematical resource which can be used for building lesson material or can be made available to the student in responding to questions during the tutorial session. The mathematical resource has the capability for the usual numerical calculation and also for algebra, functions, and matrix manipulation. Another interesting characteristic of PLANIT is that as the

instructor has composed his lesson material he can at any time play it back and examine what he has composed and edit the material dynamically as he examines it. Thus the PLANIT language gives the instructor a great deal of freedom to present material, to determine the kind of responses that should be given, to specify the kind of action that should be taken on the basis of the responses, and to record the student responses.

The other PLANIT mode is that in which the student responds to the material which has been developed by the instructor. In this mode the student has presented to him on a typewriter device or a simple cathode-ray tube device the lesson material which has been prepared by the instructor. The student simply goes through the lesson material, progressing at whatever speed is appropriate or under timing as may have been specified by the instructor. He may use the mathematical resource of PLANIT in working out his response.

At the present time, the instructor's utility is being prepared at SDC and will be made available to the education community. We are committed to have the program finished by the 1st of July 1970. We are on schedule and have been keeping interested members of the instructional community informed of our progress in this area.

Although I will consider this point in more detail later, it should be mentioned here that while the instructor's utility is based on appropriate computer hardware, the major emphasis is on software as a method of making available a resource of great flexibility which should help instructors in preparing lesson materials. Likewise, the student is given freedom to progress at his own individual rate and to respond to material in a fairly individualized fashion. I make this point to emphasize that in a well-designed computer-aided instructional capability both the instructor and the student have available a resource which allows flexibility to both participants in the education process.

IV. DEVELOPMENT OF A TUTORIAL COMMUNITY

I now wish to describe a program of development and experimentation being undertaken by Ralph Melaragno and Gerald Newmark in which they are applying evaluation-revision procedures in developing a tutorial community. The evaluation-revision procedures have developed through a long series of studies by Harry Silberman, John Coulson, and their associates at SDC. The main characteristics of the model used in developing the instructional systems to be described are: first, an empirical approach involving successive evaluations and revisions of procedures until they are known to accomplish specified behaviorally-defined objectives; second, the conduct of research and development activities in an actual school setting using normal schools, and, third, the active participation of the regular classroom teachers and school administrators with the researchers in the research and development effort. The present work grew out of some earlier studies (5) in which evaluation-revision procedures were used in developing teaching techniques with Mexican-American children in first-grade reading classes.

Preliminary work led to the belief that these Mexican-American children lacked an understanding of various relational word skills. A measure of knowledge of work concepts was developed which emphasized so-called "relational" or "direction" words, such as top and bottom, fewest, identical, largest, down, etc. For 17 of the words there was distinct evidence that the Mexican-American children did not understand the words as well as their Anglo peers. In conferences with teachers, 10 of the words were identified as being particularly important, and it was decided to see if procedures could be developed for teaching the children the meaning of these 10 words, namely, top, bottom, alike, different, first, middle, last, under, over, and underline. To most of us these words are a part of our everyday vocabulary, and are used with our children so that they get to know them. But consider the plight of the Mexican-American child who comes to school and does not understand the concept and meaning of these words. How can he follow such instructions, drawn from the reading manuals used in the Los Angeles schools, as "look at the picture at the top of the page," or

"color the pictures that are alike," or "mark the word in each block that is different," or" who is in the middle of the picture," or "draw a line under the words that are like the underlined words," if he lacks a clear notion of the meaning of such words as alike, different, middle, or underline? Though the child may well have understood the content material, he probably did not understand the directions being given. The researchers therefore decided to try to teach all of the children the behavioral referent involved in the 10 words mentioned above. Although it might seem that these words could easily be taught, in fact a number of "conventional" techniques were tried and found ineffective. Lectures by teachers, classroom demonstrations, and other traditional methods were not very effective. Finally the researchers tried using student tutors. First-grade students who understood several of the object words were paired with students who did not understand these words. This technique was explored with 10 pairs of students. Numerous observations were made of the pairs in action, and revisions were made in the type of interaction desired. The revisions tended to add more structure to the situation. The more knowledgeable students were given brief training in tutoring tasks and instructional directions for the student were tape recorded. After many trials, the technique which seemed to work best involved the following: first, the teachers examined the pretest results and determined which students were to receive this form of instruction and who their peer helpers were to be; second, the learners were seated in groups with their helpers standing behind them; third, instruction consisted of a special workbook and a tape recording; fourth, the helper had to make certain the learner attended to the correct visual material in the workbook while the tape messages were played and to provide the learner with feedback on the correctness of his responses. Though this technique helped a significant number of the students, some of the students still had not mastered the 10 words even after considerable tutoring by peers.

The next technique tried was to use older students as tutors. Techniques somewhat similar to those already described were developed for tutors from

the fifth and sixth grades. These children were given instruction regarding the materials to be used and how they were to help the first-grade students. Again, this technique proved successful and helped previously unsuccessful students to learn the object words.

The next step was to have the teachers work with the students in small groups or individually. This procedure helped some of the remaining students, but there were still a few who resisted instruction from the teacher. For these remaining students we arranged for a bilingual community worker to visit the home of the students and see if a parent or teenage sibling would be able to tutor the students in the 10 words.

All of these techniques were tried out. The materials and procedures were revised and the techniques were tried again until the experimenters were satisfied they had effective teaching materials and a system developed. At this point it was necessary to show that the technique actually worked. Three different demonstrations were conducted. First, the investigators retained major control over the conduct of the training in the classroom. Second, school personnel in the two schools where the research had been done conducted trials, with the experimenters remaining distinctly in the background. Third, school personnel in two new schools conducted the trials and the experimenters worked only through the supervisory personnel at the school. The results can be summarized as follows: when the experimenters were in charge, only two of some 50 students failed to master all 10 words. When the instruction was managed by the teachers in the school where the research was done and the experimenters were in contact with the teachers, but in the background, the number of students mastering the words was still very significant, about 80% of the students. As might be predicted, in the third situation, where the teachers received their material through the normal administrative channels, the results dropped further. One class did quite well because the teacher followed the instructions and availed herself of the various materials and

resources. In the second class, where the teacher did not follow the material as presented nor use the upper grade tutors in a systematic manner, the students fell considerably below the other class.

The experiences just described led to the feeling that a series of techniques and methods for utilizing school resources were available for significantly altering the level of achievement of students. At the same time it was recognized that the application of these techniques in ordinary school settings faced a number of difficulties. The techniques were different enough from those normally employed in the regular teacher-oriented school that they caused administrative and management problems and likewise some teachers tended to feel uncomfortable and resistant in applying them. Recognizing these problems, Melaragno and Newmark (6) tried to formulate the conditions which would allow for the effective application of the ideas growing out of this work and other innovative ideas developed elsewhere.

The basic idea underlying the tutorial community is to involve an entire elementary school in the development and application of an integrated, new approach to education which draws on many of the resources of the school and local community. The five main features which characterized the philosophy and approach underlying the development of this tutorial community were: 1) the central role of students as tutors and helpers; 2) explicit procedures for facilitating change and effective growth; 3) the gradual development of a tutorial community within the total school; 4) application of the empirical evaluation-revision strategy; and 5) a team approach with community involvement. We are trying to create a school in which students at each grade level interact with other students both as learners and teachers, a school in which the traditional barriers and distinctions between teacher and learner are broken down. It is hoped that the concept of community can be expanded to provide means for interaction of students, parents, teachers, administrators, and researchers in planning and conducting instruction and in improving the

interpersonal relations and communications among all of the people involved in the school program.

With these thoughts in mind, a proposal was made to the Ford Foundation asking for funding to implement this approach in a school in the Los Angeles School District. The Ford Foundation agreed to support the project and the Los Angeles City School District likewise agreed to supply a location in which the work could be undertaken and to make the necessary school personnel available. With the active cooperation of the teachers and the principal of the Pacoima Elementary School, the work to be described began in May 1968. The Pacoima school has a staff of approximately 66 teachers and administrators with 1500 students. Pacoima is a "pocket ghetto" in the San Fernando Valley in Los Angeles. The school population consists of 45% Negro, 40% Mexican-American, and 15% Anglo students. We have now completed the first full year of development work and seem to be meeting the objectives which were originally defined. During the first year the work was concentrated on kindergarten level students with the active participation of student tutors from the fifth and sixth grades. Naturally, the school principal as well as the teachers from those grades were actively involved.

The methods being used in this experimental work are based fundamentally on the evaluation-revision philosophy previously mentioned. Three major emphases or thrusts are being attempted in this experimental setting: 1) much of the instruction is being given through the use of tutors; 2) to facilitate the necessary intellectual and emotional acceptance and understanding of the work, encounter groups are being conducted involving both teachers and students 3) there has been an effort to involve the total community, both those in the school and those in the surrounding community. I will review the progress made during the first year by extracting material from Melaragno and Newmark's Progress Report (7).

TUTORING

The research and development activities with tutoring have been carried out in two phases. The first semester was a pre-system phase during which teachers and tutorial community project staff members explored tutor selection, tutor training, tutoring procedures, physical arrangements, materials development, evaluation, and record-keeping. In addition, communication and coordination among upper-grade teachers, kindergarten teachers, tutors, learners, and staff members had to be worked out, and roles had to be defined.

Several steps were taken to simplify procedures, to get classroom experimentation started with the least disruption of the ongoing school program, and to demonstrate the potential payoff early. Sixth-grade teachers were asked to select as tutors student "leaders" whom other students looked up to but who were not necessarily the highest achievers, anticipating that these leaders would later influence other students positively toward tutoring. Twenty-eight sixth-grade tutors underwent various types of training and tried out different tutoring approaches in the four kindergarten classes. Some tutors supervised small groups of children engaged in independent activities--painting, handwriting, listening to stories, working with blocks, and completing academic worksheets. Other tutors worked with individual children to help them master math concepts, listen to stories and answer content questions, retell rhymes, write their own names, or recognize letters of the alphabet.

The tutors generally were eager to tutor and positive about the experience, and contributed good ideas for improvements to the tutoring materials and procedures. Some tutors were stiff, shy, and impatient in the tutoring situation. At the suggestion of a kindergarten teacher, tutors spent the first few days getting the "feel" of the classroom before they began tutoring. Also, benefits tended to be lost to the kindergarten teachers, since contact between tutors and teachers was limited by the continued presence of SDC staff members in classrooms. The kindergarten teachers expressed a desire to be more involved in and have more control over all aspects of tutoring. They

also, however, felt a serious concern about finding the necessary time. Sixth-grade teachers desired to observe their students in action, and to know more about the total tutoring involvement. Daily meetings were held between project staff members and tutors, and between Project staff members and teachers. Meetings with teachers, tutors, and research staff produced some modifications to procedures, additional training for some tutors, and the identification of needed materials. A system plan emerged for uniform trial and revision in all kindergarten classes.

The second phase started at the beginning of the second semester. The system plan was introduced in the morning kindergarten classes, and is still undergoing empirical trial-and-revision. A major aspect of the plan is to provide for greater teacher/school participation in planning and conducting the operational program. One feature of the plan calls for each kindergarten classroom to receive eight tutors from one fifth-grade classroom. Fifth-graders were chosen so that at the beginning of next year a pool of experienced tutors will be available.

The tutors are trained for two roles: the supervision of independent activities, causing them to come in contact with all kindergarten students in a given class, and tutoring for specific objectives, in which each tutor has special responsibility for two or three learners and works with them on a one-to-one basis. Tutors receive two weeks of orientation and training from a tutor coordinator. The training deals with the nature of kindergarten students, learning problems, human relations, and tutoring procedures; the main training techniques used are discussion, role-playing, and supervised practice tutoring. The use of eight tutors per classroom is designed to free the teacher for discussion with, and further training of, four tutors at a time, while the other four are carrying on their activities.

Results to date have been very encouraging. For the most part, upper-grade students have responded enthusiastically, seriously, and intelligently to

training and tutoting. They have been effective in helping younger students to learn, have contributed excellent suggestions to improve the tutoring, and have shown great pride in their involvement. Their teachers report that tutors benefit a great deal from the experience and that it shows in their attitudes and schoolwork. Some of the first tutors selected were social-adjustment students, but the kindergarten teachers were not aware of this and were amazed when they found out. These students performed so well and maturely in their role as tutors, and related so well to the kindergarten children, that it was hard to see them as problem children in their own classroom. Some tutors, with very little training, showed a natural talent and ability for teaching almost immediately; others needed considerable training and experience to become effective. The kindergarten children generally enjoy receiving help from older children and seem to relate to them quite easily and naturally. Tutors' problems which have been identified are a tendency to do work for the learner rather than assist him to do it himself; unrealistic expectations of learner abilities; a tendency to be impatient and overly strict; difficulty in working with a restless learner or with problem children; loss of interest on the part of tutors if they have the same assignment too long.

Administrative support has steadily increased. The principal has appointed a social-adjustment teacher as tutor-coordinator. He has become involved in pre-service and on-the-job training of tutors, coordination between sending and receiving teachers and between project staff and school personnel, and the conduct of a weekly encounter group with tutors.

Numerous problems and difficulties have been identified during the first year of the project. During the transition period, when one system is being replaced by another that is in the process of being developed, a certain amount of disruption is to be expected. Many demands have been placed on the kindergarten teachers. The tutors initially were more a burden and worry to the kindergarten teacher than a help. Having to plan for the use of tutors, supervise their activities, and assist in developing new procedures while still

maintaining their regular program places a great burden on their time and energy. The change in the role of the teacher from having sole responsibility for 30 or more children to that of manager of a team of assistant teachers has required considerable adjustment in the thinking of the teachers. At times, some teachers exhibited little will to resolve these problems. Communication and coordination between sending and receiving teachers has been a persistent problem, and there has been too much reliance on the research staff members as intermediaries. But overall, the teachers' attitude has been increasingly positive. Initially, they were favorable to the idea, but weighed down by implementation problems. As procedures have crystallized, and as tutors have gained more experience, teachers have gained more confidence in them and can see the payoff. At first they were concerned about how much responsibility they could give the tutors. They now find that they can leave the classroom for periods of time and activities continue smoothly. They have come to depend increasingly on the tutors and state that they would be unhappy without them. They also find it stimulating and challenging to be working with the older children and younger children at the same time, and they have been conveying these positive attitudes to the other teachers in the school.

ENCOUNTER GROUPS

A second major goal of the Project is to create and maintain a learning climate that facilitates freedom of expression, change, experimentation, and cooperation, and that promotes self-awareness, affective growth, and better interpersonal communication. To achieve this goal, encounter groups are held for all concerned groups--parents, teachers, students, school administrators, and interested community people. Four types of encounter groups are being held: weekly task-oriented groups for the research and school staffs, children's encounters, weekend encounters for teachers and parents, and weekly encounters for teachers.

Task-Oriented Encounters

A weekly, two-hour, after-school, task-oriented encounter involving the research staff, all four kindergarten teachers, the principal, and the faculty chairman has been in progress since September. In a task-oriented encounter, individuals are encouraged to discuss their feelings openly and honestly in relation to Project developments. The point of departure for the discussion is the task, which the group has in common. This is different from the typical unstructured encounter in which the participants discuss any subject at all.

Several conditions that are not present in most unstructured encounters have made the progress of the group slow. The fact that participants work together daily creates some fear of getting involved in controversies that might disrupt existing relationships. The presence of the school principal has also inhibited the teachers, and his inability to attend every week (because of other commitments) has made it difficult to work through this problem. The professional facilitator could only attend sessions every other week, and this loss of continuity reduced his potential contribution.

It was generally agreed that more time was needed for the two activities of planning and encountering and that the two functions should be separated. Accordingly, each kindergarten teacher is now given one-half day a week release-time from the classroom for planning purposes. The weekly encounter group session is now conducted strictly as an encounter. In spite of these difficulties, considerable progress toward more open, frank, and direct discussions has been made. Most of the participants are less defensive and more willing and able to express and accept negative and positive feelings from others. All of the kindergarten teachers, the faculty chairman, and the principal feel the encounters should continue and want to be part of them.

Encounters involving kindergarten children were purposely delayed until the second semester to avoid overburdening the teachers by initiating too many new things at the same time. Since February, four kindergarten teachers have

been holding regular weekly sessions with 10 to 15 children in a group. Again, as with the initial tutoring efforts, the emphasis has been on exploring different arrangements for conducting such groups. The kindergarten teachers generally have been satisfied with the progress of the children's encounters and the children seem to enjoy them. Some sessions have been extremely meaningful, with children verbalizing feelings, problems, and conflicts and the group interacting creatively with each other to try to help. There are, of course, problems. Child-child interactions have been slow to develop, much interaction is still teacher-child. Teachers have been unsure of themselves and have moved slowly and cautiously with the encounters. They are sometimes impatient and have unrealistic expectations for each session. In their desire to make every session as meaningful as possible, they sometimes intervene too much. Children with special behavioral problems have sometimes been a disrupting influence, but this frequently becomes the subject of the group discussion.

There have been some very positive outcomes to date. Some children who have been very shy and withdrawn in class activities have started to open up and become involved with other children through the group discussions. Also, as a result of the encounters, teachers pay more attention to children's affective development throughout the day.

Weekend encounters sponsored by the Center for the Studies of the Person were made available to teachers and parents throughout the school year. Twenty-five teachers and 10 parents participated, and six teachers went to a second workshop. The reactions of teachers to the weekend encounters have been very positive.

COMMUNITY INVOLVEMENT

The third major goal of the Project is to close the gap between the school and the community, to change from a we-they orientation to a cooperative spirit of mutual confidence and involvement--a community spirit in which

teachers, administrators, parents, and community people share responsibility, concern, pride, and satisfaction in a common effort to improve the learning of all.

At the time the Tutorial Community Project started community involvement was not high. The principal of Pacoima Elementary School is active in community affairs, knows most of the local leaders and agencies, attends evening meetings frequently, and is generally accessible to parents and other community persons. However, no strong school-wide effort has been made to get teachers more involved with the community; as a result, school-community relations are, at best, apathetic. Very few parents visit the school, know what is going on in the school, or have the opportunity to make suggestions or react to planned changes. PTA meetings are poorly attended and are usually one-way presentations. Parents feel like outsiders in the school, and teachers feel like outsiders in the community.

Two residents of Pacoima (one Black and one Brown) serve on the Project staff as community aides; their primary responsibility is to act as a liaison between the staff and the community at large. They meet with persons in the community to describe the Project and encourage participation, and they bring to the staff community questions and concerns. Since the tutoring and children's encounter groups are going on at the kindergarten level this year, much of the emphasis in community involvement has been with the parents of kindergarten students. Attempts to establish a kindergarten Parents Advisory Group have not been successful as yet; several parents have volunteered, but attendance at weekly meetings has been so sporadic that the group could not function meaningfully. Other Project interactions with the community have included: an evening Open House held at the Project office across from the school; regular meetings with the PTA Board; letters to parents when a student was selected to tutor, followed by visits from community aides; a luncheon for parents of tutors, held at the home of one of the community aides; and a newsletter to parents describing Project activities. Project co-directors and

the school principal participate in the Pacoima Optimists Club, where they interact with community leaders, and have assisted the San Fernando-Pacoima School Advisory Board in formulating their charter. Briefings have been held periodically for local teachers and administrators and other community persons. A major activity, presently underway, is the establishment of a 15-man school-community advisory board.

Present Status

Present Project activities are concerned primarily with evaluating this year's experience, formulating tentative plans for the future, discussing with faculty and community persons' progress to date and ideas for the future. In evaluating progress to date, interest has centered on student achievement, the effectiveness of research and development procedures, and the overall climate in the school. The data to be used for the evaluation is being gathered from tests, school records, questionnaires and interviews, and the observations and recommendations of a special Evaluation Team, consisting of persons of varied professional backgrounds.

The form that the Project will take next year involves these major aspects: 1) involvement of teachers and students at all grade levels in the individualization of instruction through tutoring; 2) increased participation of teachers and community members in encounter groups; 3) significant changes to the school's organization and operation to facilitate the development of a "tutorial community"; and 4) working more intensively with subsets of teachers, at all grade levels, who have indicated a strong desire and readiness to change. It is apparent that success in achieving these goals will depend on the skill and understanding of the Tutorial Community Project staff members. To be fully successful they must develop a transferable technology which will enable others to apply the methods in new settings.

IV. THE APPLICATION OF EDUCATIONAL TECHNOLOGY

Elsewhere I have discussed the systems approach and its use in education (1).

The development of educational technology is closely related to the total system approach, and, indeed, the development of the tutorial community described previously can be thought of as the development and application of a total system cycle for the obtaining of defined educational objectives. The definition of educational objectives is a subject of great importance and one which should receive much more attention. Consider, for example, work by John Coulson and his colleagues (2) in developing an instructional management system. Although teachers and curriculum experts could agree on the goals to be achieved in first-grade reading, when they tried to define these objectives at a level which was appropriate for the management of day-to-day instruction, the statement of objectives turned out to be much too gross and vague to enable a definitive assessment of objectives. The previously stated objectives did not allow the specification of behaviors to be achieved from day to day or even to define the precise instructional material which should be used to achieve specified goals. The point is that it is easy to specify gross educational objectives but there is much detailed work and the application of defined procedures which need to be followed in translating these gross objectives into behavioral elements.

Early in this paper I made the point that educational technology was by no means synonymous with hardware applied to education. In the examples cited, hardware had a relatively insignificant role relative to the software that was being developed. This point can be overemphasized since it is certainly true that for the effective application of certain kinds of educational technology it is essential that hardware be in place, in good condition, and operative. The hardware may vary from extremely complex equipment, such as large computers, to closed circuit television, to 16 mm. projectors, to smaller audiovisual materials and to tapes with cassettes. I do not wish to underestimate the contribution that equipment, in conjunction with appropriate software, can make in education. Nevertheless it should be emphasized that the limiting factor in the development of much educational technology is not hardware but rather software. The development of good instructional

materials, whether they be computer tapes with CAI instructions, video tapes, or films, is not limited by equipment but rather by the extent to which there have been adequate resources to develop, try out, revise, re-try out, and re-develop the software involved. Generally it will be as expensive, if not more expensive, to develop adequate software as it will be to develop the corresponding hardware. In the past we have frequently taken the other point of view; namely, if we had the money to buy the equipment somehow the software would be available. This attitude is incorrect and one of the results has often been a rejection of technological developments because of disappointments that have inevitably arisen when such new methods lacked adequate lesson materials.

Finally, the description of the tutorial community points up that educational technology is much more than hardware and software. Indeed, there is a whole set of skills and techniques which any education practitioner needs to learn. The ways of working effectively in the classroom; the use of resources, such as other students as tutors; the establishment of an atmosphere in which there is sufficient freedom to undertake new methods, even if they fail; all of these are also a part of the technology of education. We probably know less about this area than about hardware and software, yet in the long run, these techniques will be more important than the more readily-defined and easily-understood hardware-associated technology.

Emphasis on hardware, on software, and on procedures raises question about the role of the teacher. In the past we have often thought of teachers as a people with professional training which has given them knowledge of a particular subject matter, as well as certain skills in the role of an instructor in the classroom. I would suggest that in the near future the professional teacher will need to have a more intensive training in those areas which I have discussed today. I also believe that there will be a greater role differentation in the educational community. The professional teacher will be restricted to the establishment and management of an

environment in which learning can take place at an effective rate, utilizing the available resources, whether his own, those of other members of the school community, or generally available equipment and procedures. Similarly, I believe there will be a new group, perhaps known as educational engineers. This group will be much more concerned with the development of the various educational technologies which will be made available to the teacher. These educational engineers will not be engineers in the traditional sense; indeed, they may by psychologists, educational researchers, computer programmers, and perhaps electronics engineers, but they will be characterized by an ability to develop effective technologies for use in the educational system. If they are truly professional they will be concerned with showing that these techniques and procedures are indeed effective and are worthy of the attention and use by the professional teacher.

(Last Page)

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